LessonTitle: **Geometric Probability Geo 5.3**

Utah State Core Standard and Indicators Geometry Standards 5.2 Process Standards 1-5

Summary

This lesson contains several activities that use area and length to model probability. The first activity asks students to calculate the probability of landing on a given area within a shape. The next activity gives students possible sides of triangles and asks the probability that they would create a triangle. Students must understand the triangle inequality for this activity. The final activity uses geometric area and expected value to answer questions involving a game.

Enduring Understanding	Essential Questions
Finding the probability of an event occurring within a given space involves using principles of length and area. Geometric length and area can also be used to model the probability of an event outside a spatial context.	How is the probability of an event modeled using length and area?
Skill Focus	**Vocabulary Focus**
Using length and area concepts to find or model the probability of an event within our without a geometric context	

Assessment

Materials: Calculators

Launch

Explore

Summarize

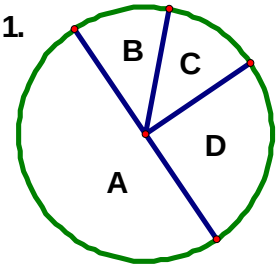
Apply

Geometric Probability Problem Solving

I. Dart board Probability

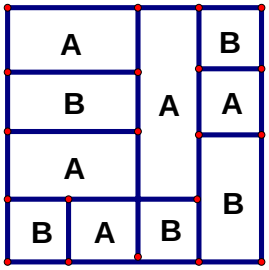
Suppose you throw a dart randomly at each of the boards. Assuming the dart strikes the board each time, determine the probability of its landing in the area indicated. Assume that angles that look like they are 90 degrees are actually perpendicular.

1.



P(A) =
P(B) =
P(C) =

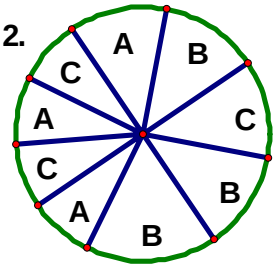
3.



P(A) =
P(B) =
P(C) =

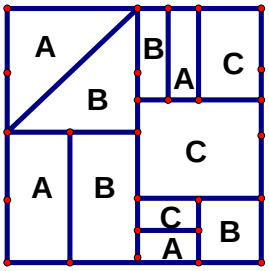
A

2.



P(A) =
P(B) =
P(C) =

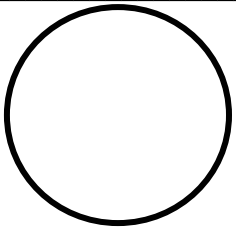
4.



P(A) =
P(B) =
P(C) =

5) For each board what should be the sum of the probabilities? _____

6) Make up a dart board marked red, green and blue such that the P(red) = 1/3 and P(blue) = ¼. Determine P(green)_____.



2) Avoiding the Flood

Tally and her friends are driving from Moab to a camping spot near Lake Powell (about 110 miles). At some random time during her trip, a flash flood will occur at a location 40 miles from Moab. There will be delays for 5 miles on either side of the flood. Draw a map of the problem.

a) Predict the probability that Tally and her friends will be beyond the delay zone when the flooding occurs. Show all work.

b) Find the probability that Tally and her friends will be outside the delay zone (either before or after the delay zone) when the flooding occurs. Show all work.

3) Triangle Probability (Show all work and strategies)

1) Let A = {3, 5}, B = {4, 5, 12}, and C = {5, 13}. Suppose x is selected randomly from A, y from B, and z from C. what is the probability that…

a) a triangle can be formed with sides of length x, y, and z?

b) an isosceles triangle (non-equilateral) can be formed with sides of length x, y, and z?

c) an equilateral triangle can be formed with sides of length x, y, and z?

2) A bag contains sticks of length 2, 3, 4, 5 and 6. If three sticks are selected randomly from the bag, what is the probability that

a) a triangle can be formed with these three sticks?

b) a right triangle can be formed with these three sticks?

c) a right triangle can be formed with these three sticks, given that the three sticks can be used to form a triangle

3) Playing Fair at the Fair (Taken from February, 2003 Mathematics Teaching in the Middle School, Mary Lou Metz)

Students at West Jordan Middle School are planning to hold a spring mathematics fair as a service project to raise money for a local charity. Mrs. Nielson's eighth grade mathematics class is in charge of the "What's My Probability?" booth.

The students decide to have a penny throw as one of the games but cannot agree on what shape the target should be. They all agree that the target should consist of a circle with a diameter of 1 meter and a square. Carl thinks that the target should consist of a circle inside a square that is 1 meter on a side (figure a). Melanie thinks that it should be a square inside a circle that has a diameter of 1 meter (figure b). Sam thinks that either figure would yield the same result. The player wins when the penny lands inside the outside corner or curved areas.

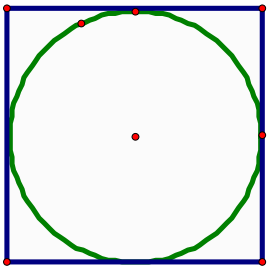


Figure a

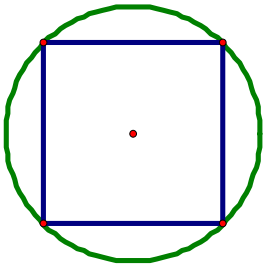


Figure b

1) For the students to make money on the game, whose figure should they choose?

2) Amanda thinks that the students should make the target half as big so that the probability of winning is cut in half. Is Amanda correct in her idea? Why or why not?

3) Next, the students must decide how much to charge for playing the game and how much they will pay the winner. Mrs. Nielson suggests that basing the amounts on expected value would be interesting. She explains that the expected value of a game is the amount of money the player can expect to win or lose when playing the game. Would the students want their game to have a positive or negative expected value?

4) Suppose that the students decide to charge $.25 to play the game and pay the winner $1.00. What is the expected value of the game? Would this value be good for the player or for the students who are trying to raise money?

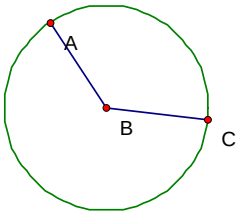
5) What might be a good price to charge for the game?

6) What are some other factors to consider in designing this game?

5) Probability with Sectors and Arcs

Terry and Joanne are designing another game for the fair. Again the students will throw pennies. However this time the students will win prizes

What is the probability the penny would land on …



$m\angle ABC = 131^\circ$

The short arc?_____

The long arc ?_____

The small sector _____

The large sector?_____

Decide on how to play the game. How much would you charge? How many pennies could they throw? What prizes could they win and how could they win them?